I-215 Rigid Pavement, High-Volume Pavement Marking System

Interim Report

Experimental Feature X(04)01

By: Michelle Page, P. E., Program Manager
Barry Sharp, Research Specialist
Andrew Stromness, Intern

Utah Department of Transportation
Research Division

June 2005

Introduction

This is an interim report for an experimental feature conducted by the Utah Department of Transportation on the various types and applications of pavement markings. This experiment included the participation of six pavement marking vendors and five marking materials.

The test section is located on the west side of I-215 between 700 North and the Davis County Line, in both traveling directions. The materials were placed in July – September 2004. All solid longitudinal lines were removed using a diamond blade, then the concrete was grooved 20 – 120 mils for the placement of the material.

Background Information

UDOT is continually looking for a pavement marking material that will provide a long life with a low life cycle cost. UDOT also requires a material that is able to withstand the extreme winter conditions in Utah. In general UDOT uses epoxy and waterborne paint, and 3M tape. Prior research has not yet defined the most cost effective and efficient pavement marking materials.

Generally, the accepted philosophy is that placing a material in a groove where the snowplows will ride on the surface rather than the traffic marking material will improve the life and durability of this material. However grooving costs too much, makes a material dirty (due to sand and dust settling in the groove), ruins wet-night reflectivity (a wet film obtusely reflects headlights), and locks lane alignment. Management has typically deterred from grooving-in pavement markings. However, on high-volume roads, anything that can enhance durability should be considered.

Five different materials and 10 total products were selected for evaluation on this project: 2 preformed tapes, 1 epoxy, 2 methyl methacrylates (MMA), 1 thermoplastic, and 2 waterbornes. Poly-urea, a durable marking, was not selected for this study because UDOT is evaluating a grooved in section on concrete.

Each material was applied in ½ mile sections. The NB section was grooved to a depth that is equal to the material thickness. The SB section will have a 100% removal of the existing lines. Each material was applied for a total of one mile, solid yellow and solid white, there were no skips. The tape is the only exception; it was installed in ½-grooved section.

Construction Information

TMT Pathway and Swarco decided not to participate in the project. Therefore, there was only one methyl methacrylate and three tapes installed.

Construction was set to take place over the weekend of July 16-19, 2004. This began with line removal and grooving for one day, two nights. During their removal there was a heavy rainstorm that halted removal for several hours. When removal did resume the pavement still contained some moisture causing the dust from removal to stick to the pavement. This was a concern during the placement of the project because it caused the freshly placed markings to not adhere properly.

Initial construction plans included the removal and replacement of all longitudinal lines, including skips. During the removal process it was discovered that the majority of the skips were tape or thermoplastic paint, which could not be removed by the diamond saw blade. In order to remove these materials a carbide blade would have been required. The decision was made to only do removal and replace the longitudinal solid lines, where the existing paint was epoxy and waterborne and could easily be removed with the diamond blade.

Markings were placed on July 17-18. Polycarb, placing epoxy, was the only vendor to place markings on the 17th. Twenty mils of epoxy were applied into a 30-mil inlay. The pavement temperature during the placement was 101.7 °.

On July 18 two waterborne paints were placed, one by Pervo, and one by Ennis. Both waterborne paints were applied at a thickness of 20 mils, inlaid 30 mils. Pervo placed their material when the pavement temperature was 77 °, and Ennis placed their material when the pavement temperature was 82 °.

Methyl Methacrylate (MMA), provided by Ennis, was placed on July 18. The placement of the MMA was postponed until early evening due to high pavement temperatures during the day. MMA cannot be placed when pavement temperatures exceed 105 °. The MMA was placed 90 mils thick, and was inlaid 120 mils. The pavement temperature during placement was 91°. Due to problems with the application equipment, the MMA yellow solid line was not installed.

Thermoplastic tape, also provided by Ennis, was placed the same day at a thickness of 90 mils, and inlaid 120 mils. Thermoplastic must be heated to 400 °+ for application. Heating the material to this temperature was time consuming and took several hours.

All three vendors that were supplying tape require a 24-hour window after precipitation before placement of their materials. Due to this restriction and the

storm on the night of July 17, UDOT was unable to have the tape products placed during the initial freeway closure.

The night of July 29, single lanes were closed for the placement of tape. 3M placed 70-mil thick tape, inlaid 90 mils. The other two vendors, Briteline and ATM, placed 60-mil thick tape, inlaid 70 mils. The pavement temperatures ranged from 77 ° - 82° during the installation. The products provided by ATM and Briteline required the placement of primer prior to the tape installation, while the 3M products did not.

The skip lines were able to be removed on the stretch of freeway where the tape was being installed. Due to time constrictions during the night closure none of the vendors were able to place any skips on July 29.

All three tape vendors returned to place contrast tape in the skips in their respective areas at a later date. ATM placed their contrast tape on August 22, and the other two vendors placed their tape on September 12.

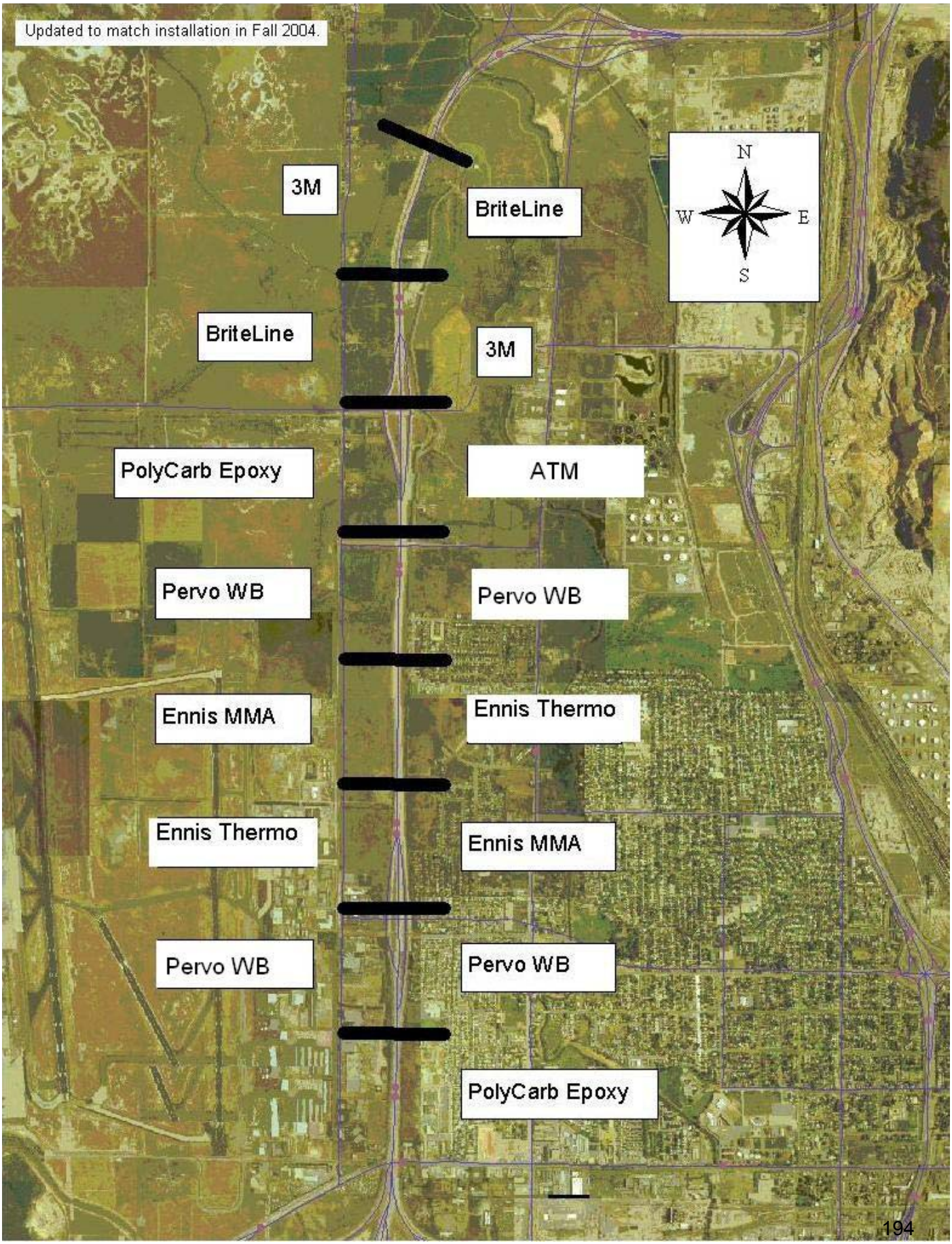
Grooved-in Markings (NB + Tape)

Material	Location Begin North	Location End North	Location Begin West	Location End West	MM	Pav. Temp	Air Temp	Rel Humid	Wind Speed/Dir.	Mil Thickness	Groove Depth
Epoxy	40.48.338	40.48.770	111.56.963	111.56.972	23.12	101.8	84	33	0	20	30
WB 1 (Pervo)	40.47.905	40.48.338	111.56.979	111.56.963	23.621	90.9	77	28	0	20	30
MMA (Ennis)	40.47.465	40.47.905	111.56.969	111.56.979	24.101	126.5	91	13	0	90	120
Thermo (Ennis)	40.47.028	40.47.465	111.56.962	111.56.969	24.616	125.2	92	13	0	90	120
WB 2 (Ennis)		40.47.028		111.56.962	25.112	97.5	82	19	0	20	30
Tape 2 (ATM)	40.48.767	40.49.202	111.59.939	111.56.950	25.591	85.3	82	17	0	60	70
Tape 1 (3M) White	40.49.202	40.49.622	111.56.950	111.56.835	26.082	80.6	77	23	0	70	90
Tape 3 (BL)	40.48.770		111.56.972		26.145	80.6	77	23	0	60	70
Tape 1 (3M) Yellow		40.49.634		111.56.862	26.572	84.9	80	21	0	70	90

Surface Prep Markings (SB)

Material	MM	Pav.Temp	Air Temp	Rel Humid	Wind Speed/Dir.	Mil Thickness
Epoxy	25.562	101.8	84	33	0	30
WB 1	25.076	90.9	77	28	0	20
MMA	24.576	126.5	91	13	0	90
Thermo	24.068	125.2	92	13	0	90
WB 2	23.564	97.5	82	19	0	20

Note: An aerial map showing the installation locations of each product in the test section is shown on the following page.


Updated to match installation in Fall 2004.
3M
BriteLine
BriteLine
3M
PolyCarb Epoxy
ATM
Pervo WB
Pervo WB
Ennis MMA
Ennis Thermo
Ennis Thermo
Ennis MMA
Pervo WB
Pervo WB
PolyCarb Epoxy
N
W
E
S

The following chart contains the handheld retroreflectivity readings for the test section for Fall 2004 and Spring 2005. These readings do not contain any information regarding the skip reflectivity, as the roadway was not closed for readings.

I-215 Direction	Location	Vendor/Product	8/19/2004 8/22/2004 Readings Handheld	5/18/2005 5/19/2005 Handheld Readings
NB	Outside Shoulder	PolyCarb Epoxy	465	191
	(White)	Pervo WB	327	130
		Ennis MMA	241	128
		Ennis Thermo	382	276
		Ennis WB	287	167
		ATM	569	196
		3M	808	713
		BriteLine	--	--
	Inside Shoulder	PolyCarb Epoxy	382	206
	(Yellow)	Pervo WB	303	171
		Ennis WB	--	100
		Ennis Thermo	182	221
		Ennis WB	141	139
		ATM	479	268
		3M	--	--
		3M	--	
SB	Outside Shoulder	3M	--	--
	(White)	BriteLine	608	149
		PolyCarb Epoxy	288	299
		Pervo WB	359	229
		Ennis MMA	226	154
		Ennis Thermo	320	297
		Ennis WB	266	140
	Inside Shoulder	3M	451	387
	(Yellow)	BriteLine	391	190
		PolyCarb Epoxy	224	211
		Pervo WB	248	153
		Ennis WB	--	--
		Ennis Thermo	160	194
		Ennis WB	172	136

Recommendations

Currently, the Research Division in coordination with Maintenance, Traffic & Safety, Central Materials and the regions are evaluating all pavement marking data on a Statewide basis to provide recommendations as to what products perform best under specific conditions and at what cost/benefit to the department.